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Forest Treatment Opportunities for Kansas 1982-1991

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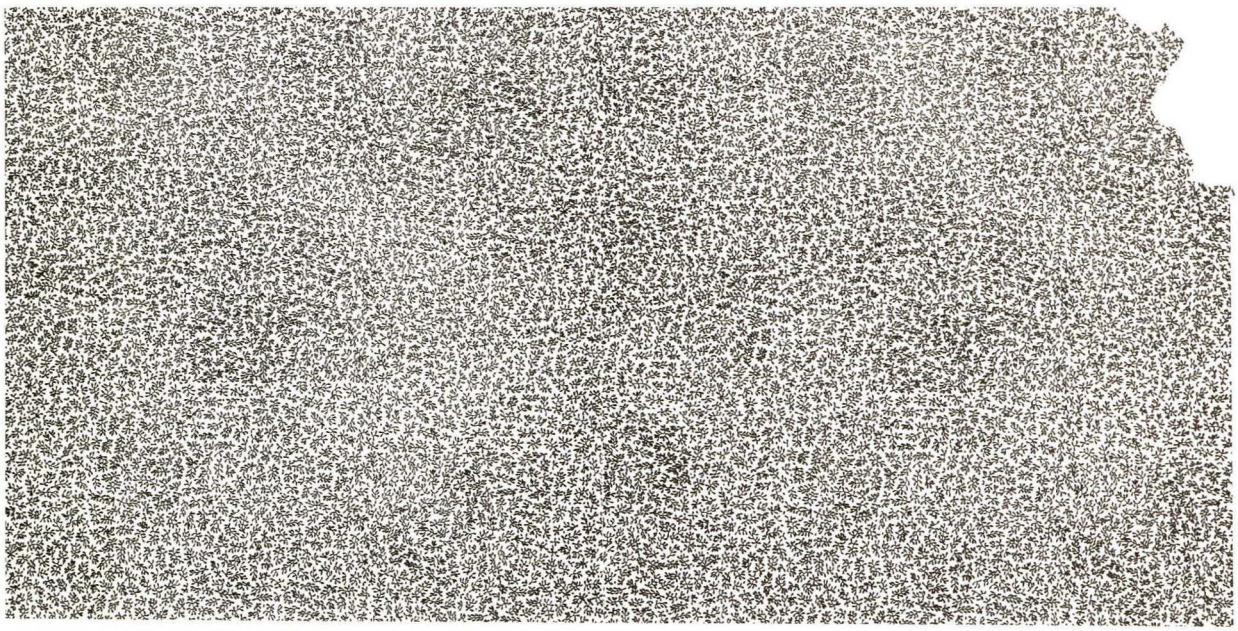

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FOREST TREATMENT OPPORTUNITIES FOR KANSAS 1982-1991

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Forest Inventory and Analysis (or Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. In 1981, the Forest Inventory and Analysis Project at the North Central Forest Experiment Station conducted the third forest survey of Kansas in cooperation with State and Extension Forestry, Kansas State University.

Kansas is not noted for its forests; however, the State has 1.4 million acres of wooded land that is vital to the quality of life in the area. Kansas' forests, primarily hardwood, are composed of two major forest type groups: oak-hickory and elm-ash-cottonwood. Oak-hickory is found mostly on the eastern uplands, while elm-ash-cottonwood is abundant in the eastern lowlands and along the stream bottoms into the western reaches of the State (fig. 1).

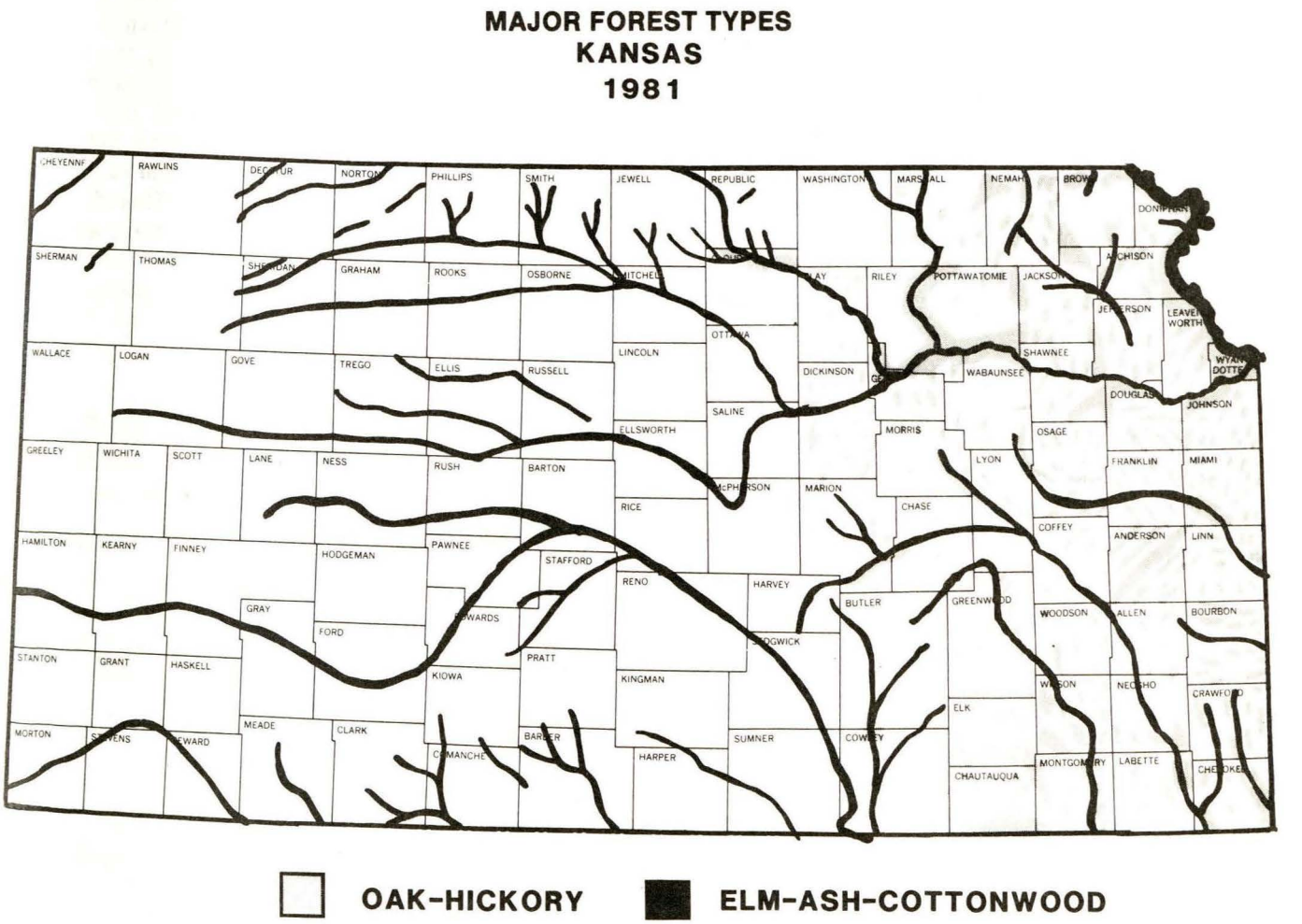

Figure 1.—*Kansas forest type groups map.*

These forests provide timber products as well as shelter and protection for homes, farmsteads, fields, and wildlife. As shown in the following tabulation, in 1981 approximately 1.2 million acres of this wooded land is commercial forest land deemed capable of producing commercial crops of timber and is not withdrawn from utilization by statute or administrative regulation.

Land Class	Area (Acres)
Forest land	
Commercial	1,207,900
Noncommercial	150,800
Total	1,358,700
Nonforest land	50,979,300
Total all land	52,338,000

The potential for managing commercial forest land in Kansas is the subject of this report. Treatment opportunities during the decade 1982-1991 were identified for projected forest conditions in Kansas. The treatments evaluated were: (1) harvest, (2) thinning (commercial and precommercial), and (3) stand conversion or restocking. We compared projected stand conditions to treatment criteria and determined the area qualifying for each treatment during the decade. Timber volumes occurring in stands selected for treatment were tabulated; they represent what could be removed if treatments were carried out.

Treatment criteria for Kansas were adopted from criteria identified in conjunction with the State and Extension Forestry Office and management practices identified in other Plains States. They reflect management practices feasible for current forest conditions on commercial forest land in the State (table 1).

There is no single or correct evaluation of treatment opportunities for Kansas. Rather, opportunities differ according to the treatment criteria specified. The findings presented here are the result of just one of many possible sets of treatment options.

ASSUMPTIONS

In order to conduct the analysis, we made three basic assumptions: (1) the area of commercial forest land (1.2 million acres) will remain stable for the decade 1982-1991, (2) all commercial forest land is available for treatment, and (3) a ready market exists for all species and products. We did not consider possible economic, social, or political constraints on treatment opportunities.

METHOD

Treatment opportunities are projected for a decade because this is viewed as a reasonable planning period, and because ideally, forest inventories are conducted every 10 years. In practice, treatments would occur throughout the decade. An estimate of the average annual volumes removed during the treatment period should reflect the growth that would occur on plots between 1981 (when the data were collected) and the time of treatment. Therefore, we projected each plot 5 years as an estimate of average

Table 1.—*Harvest and timber stand improvement criteria used in assessing treatment opportunities, Kansas, 1982-1991*

Forest type	Site index range	Rotation age for harvest	Thinning[1]	
			Pre-thinning basal area	Post-thinning basal area
	Feet	*Years*	*----Square feet----*	
Eastern redcedar-hardwood	All sites	60	—	—
Post-blackjack oak	0-55	100	90	65[2]
	56+	80	90	65[3]
Oak-hickory	0-55	100	90	65[2]
	56+	80	90	65[3]
Upland elm-ash-locust	All sites	90	90	65
Upland plains hardwoods	0-55	100	90	65[2]
	56+	80	90	65[3]
Cottonwood	All sites	40	—	—
Willow	All sites	40	—	—
Lowland plains hardwoods	All sites	70	90	70
Elm-ash-cottonwood	All sites	70	90	70

[1]Stands must be more than 10 years from harvest age to be considered for thinning.
[2]Stands must be less than 41-years-old to be considered for thinning.
[3]Stands must be less than 51-years-old to be considered for thinning.

growth for the decade before we evaluated treatments. To accomplish this, plot data from the 1981 Kansas Forest Inventory were used as input to the Stand and Tree Evaluation and Modeling System (STEMS).[1] The System "grew" each plot for 5 years, calculating areas and volumes represented by the plots. After the projection, we used the following process to identify treatment opportunities (fig. 2):

(1) Identify areas for stand conversion or restocking

The basal area for each plot was compared to the stand age to see if the plot would achieve full stocking. A plot was selected for stand conversion or restocking if plot basal area was less than 19 +(0.38 ×stand age).

(2) Identify areas for harvest

Harvest acreage was calculated for each forest type for the decade 1982-1991 using criteria outlined in table 1. All plots at rotation age or above were selected for harvest. Harvest volume is the projected volume found on harvest plots.

(3) Identify areas for thinning

Thinning acreage was calculated for each forest type for the decade 1982-1991 using criteria outlined in table 1. Stands selected for thinning must be at least 10 years less than rotation age. In the oak forest type, thinning on better sites would occur only in stands less than 51-years-old. Thinning on poor sites would occur only in stands less than 41-years-old.

On plots selected for thinning, STEMS assigned the highest thinning priority to cull trees, then growing-stock trees of undesirable species (elm, boxelder, and noncommercial species), and finally growing-stock crop trees. Large diameter growing-stock crop trees were favored for retention during thinning operations. Trees were "thinned" from the plot until the recommended post-thinning basal area was reached. Thinning volume is the projected volume of trees removed during thinning.

FINDINGS

Harvest Treatment Opportunities

Area

According to the treatment criteria used in this analysis, 293,244 acres of commercial forest land could be harvested by 1991 (Appendix table 5). Many of the stands in Kansas are mature and should be harvested. Seventy-eight percent of the total cottonwood acreage qualified for harvest, as did 31 percent

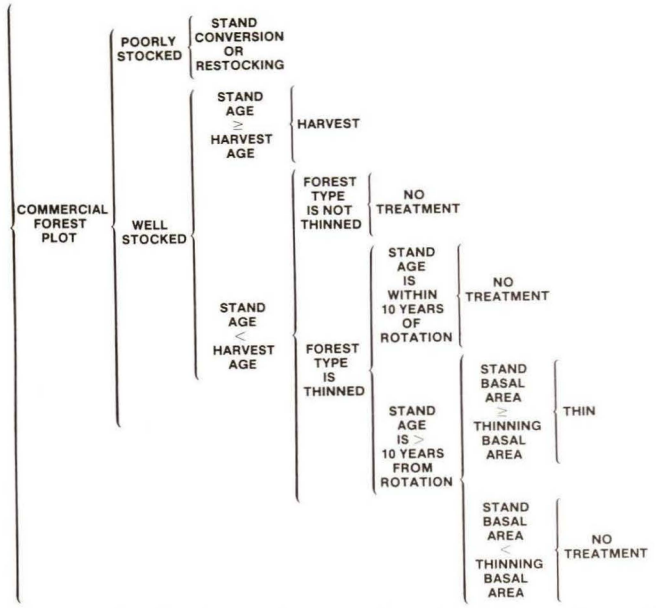

Figure 2.—*Logic used to assign treatments to each forest inventory plot.*

of the lowland plains hardwoods acreage, and 25 percent of the elm-ash-cottonwood acreage. In the cottonwood forest type many of the stands are overmature—more than half of the stands are at least 20 years past the identified rotation age. Although some of the cottonwood stands identified for harvesting are on sites with a low site index, nearly three-fourths of the sites have a site index over 60.

Volume

Timber volume on commercial forest land selected for harvest totals 43.7 million cubic feet annually during the decade, 40.4 million cubic feet in growing-stock trees. An average of 1,379 cubic feet of growing-stock including 4,542 board feet of sawtimber would be removed for every acre of commercial forest land harvested. Growing-stock and sawtimber removals are highest in the cottonwood forest type at 2,094 cubic feet per acre and 7,072 board feet per acre, respectively.

Forest type	Average harvest volume per acre	
	(Cubic feet)	(Board feet)[2]
Eastern redcedar-hardwood	936	2,238
Post-blackjack oak	812	2,846
Oak-hickory	1,093	3,803
Upland elm-ash-locust	927	2,073
Upland plains hardwoods	1,010	2,388
Cottonwood	2,094	7,072
Willow	369	876
Lowland plains hardwoods	1,325	4,514
Elm-ash-cottonwood	1,289	3,922
All types	1,379	4,543

[1] *U.S. Department of Agriculture, Forest Service. A description of STEMS: The stand and tree evaluation and modeling system. Gen. Tech. Rep. NC-79. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1982. 18 p.*

[2] *International ¼-inch rule.*

Thinning Treatment Opportunities

Area

During the decade, 105,928 acres of commercial forest land qualified for thinning. The oak-hickory, lowland plains hardwoods, and elm-ash-cottonwood forest types accounted for 83 percent of all stands in need of thinning.

All the thinned stands were between 30- and 70-years-old. The average site index of stands selected for thinning was 70. Although most of the thinned area is in stands less than 20 acres in size, 3,713 acres annually are in stands at least 20 acres in size (table 2).

Volume

Volumes from thinnings total 7.2 million cubic feet annually for the decade, 5.9 million cubic feet in growing-stock trees. The average growing stock removed during thinnings is 554 cubic feet per acre thinned. Oak, elm, ash, and hickory poletimber trees account for 41 percent of the growing-stock volume thinned.

Stand Conversion or Restocking Treatment Opportunities

Area

Because of inadequate stocking, 147,872 acres of commercial forest land in Kansas will be targeted for stand conversion or restocking during the decade. These stands include 54,957 acres of upland forests and 47,515 acres of lowland forests. Additionally, 45,400 acres of nonstocked forest land would be restocked. The average site index of stands selected for stand conversion or restocking is 58. Forty-six percent of these areas are stands less than 10 acres in size.

Table 2.—*Annual area of commercial forest land qualifying for treatment by stand-size class and treatment class, Kansas, 1982-1991*

(in acres)

	Treatment class		
Stand size	Harvest	Thinning	Stand conversion or restocking
1-4 acres	7,165	1,798	3,384
5-9 acres	6,996	3,061	4,944
10-19 acres	7,620	2,020	2,515
20-39 acres	3,815	1,578	1,534
40-79 acres	2,121	580	887
80-159 acres	1,125	1,209	753
160-319 acres	367	347	642
320-639 acres	115	—	128
All classes	29,324	10,593	14,787

Volume

If stands to be converted or restocked were clearcut before treatment, 4.0 million cubic feet of timber could be recovered annually—3.4 million cubic feet in growing-stock trees. This averages 232 cubic feet of growing stock removed per acre undergoing stand conversion or restocking. Most of the growing-stock volume removed is in sawtimber-size trees, with oak and cottonwood sawtimber accounting for 41 percent of the volume.

DISCUSSION

According to the criteria used in this analysis, 547,044 acres of commercial forest land would benefit from some treatment during the decade 1982-1991. The most common treatments needed are restocking, stand conversion, and harvest. Restocking and stand conversion are needed on 147,872 acres during the decade, while harvest is needed on 293,244 acres.

The harvest opportunities identified here will not result in a sustained yield or even flow of timber volume from Kansas' forest land. The annual harvest area and volume under even-flow management would be less than that shown here.

In order to put Kansas treatment opportunities into perspective, it is useful to compare potential annual harvest of various species during the next decade with harvest figures from recent surveys. Generally, the supply of harvestable timber from commercial forest land appears to be adequate during the next decade to meet the current demand for product raw materials (Appendix, table 3). Notable exceptions are black walnut sawtimber and eastern redcedar growing stock and sawtimber. If the 1980 demand level persists, sources other than harvest of commercial forest land will have to be tapped to provide the supply. Thinning on commercial forest land will provide some relief, but timber from silvicultural activities on other land classes such as wooded pasture and wooded strips will be more likely sources of the total additional material required.

The demand for oak, ash, and hackberry has increased sharply since the mid-1960's. Demand for fuelwood has accounted for a good portion of this increase. If this trend continues, pressure almost certainly will be increased on the supplies of these species for saw log products.

Fuelwood was the most prominent forest product in Kansas in 1980, comprising 63 percent of the growing stock and 48 percent of the sawtimber harvested in the State (Appendix, table 4). The potential for commercial management opportunities other than fuelwood seem greatest in hardwood saw logs and veneer. Increased walnut management is one attractive alternative given the species' high value, high demand, and tight supply situation.

For many reasons, the treatments identified here may not be carried out. Wood production may not be a priority for some land owners. These owners may consider timber management incompatible with their ownership objectives. Social or political considerations may limit timber management. Traditional markets may not exist for some of the products removed during treatment. Distance to markets may make some treatments uneconomical. However, with interest running high for using wood biomass and with new technology developing, new markets may be opening for many products. Stand size is another concern in assessing treatment opportunities which relates to the extent of the forest in the same general management condition. Forty-seven percent of all areas targeted for treatment during the next decade are less than 10 acres in size.

Therefore, the acreages targeted for treatment in this report are the biological maximum available, given the treatment criteria and current Kansas forest conditions. Forest managers and planners can use their knowledge of the local resource to temper the findings to fit conditions in their areas. Additionally, in many cases landowner interest in multiple benefits such as soil and watershed protection and wildlife enhancement may provide the added incentive to apply treatment to woodlands where wood production alone is not sufficient incentive.

Although this report has been devoted solely to commercial forest land, other excellent opportunities exist for managing timber on land not classified as commercial such as wooded pasture, wooded strips, and windbreaks—together they cover some 546,000 acres in the State. Landowners who would like guidance in obtaining trees, improving their stands, or harvesting timber are advised to contact State and Extension Forestry, Kansas State University, Manhattan, Kansas 66502, or their County Extension Office. Detailed statistical and analytical reports covering other aspects of the recent Statewide forest inventory are also available by contacting State and Extension Forestry, 2610 Claflin Road, Manhattan, Kansas 66502, or the Forest Inventory and Analysis Unit, USDA Forest Service, North Central Forest Experiment Station, 1992 Folwell Avenue, St. Paul, MN 55108.

APPENDIX

PRINCIPAL TREE SPECIES GROUPS IN KANSAS[3]

Softwoods
- Eastern redcedar ..... *Juniperus virginiana*

Hardwoods
- White oak
  - Bur oak ..... *Quercus macrocarpa*
  - White oak ..... *Quercus alba*
  - Chinkapin oak ..... *Quercus muehlenbergii*
  - Post oak ..... *Quercus stellata*
- Red oak
  - Northern red oak ..... *Quercus rubra*
  - Shumard oak ..... *Quercus shumardii*
  - Black oak ..... *Quercus velutina*
  - Blackjack oak ..... *Quercus marilandica*
  - Pin oak ..... *Quercus palustris*
  - Shingle oak ..... *Quercus imbricaria*
- Hickory
  - Pecan ..... *Carya illinoensis*
  - Shellbark hickory ..... *Carya laciniosa*
  - Mockernut hickory ..... *Carya tomentosa*
  - Shagbark hickory ..... *Carya ovata*
  - Bitternut hickory ..... *Carya cordiformis*
  - Black hickory ..... *Carya texana*
- Basswood
  - American basswood ..... *Tilia americana*
- Hard maple
  - Sugar maple ..... *Acer saccharum*
- Soft maple
  - Silver maple ..... *Acer saccharinum*
- Elm
  - American elm ..... *Ulmus americana*
  - Siberian elm ..... *Ulmus pumila*
  - Slippery elm ..... *Ulmus rubra*
- Ash
  - Green ash ..... *Fraxinus pennsylvanica*
  - White ash ..... *Fraxinus americana*
- Sycamore ..... *Platanus occidentalis*
- Cottonwood
  - Eastern cottonwood ..... *Populus deltoides*
- Willow
  - Black willow ..... *Salix nigra*
- Hackberry ..... *Celtis occidentalis*
- Black cherry ..... *Prunus serotina*
- Black walnut ..... *Juglans nigra*
- Boxelder ..... *Acer negundo*

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[3]*The common and scientific names of tree species are based on: Little, Elbert L., Jr. Checklist of United States Trees (Native and Naturalized). Agric. Handb. 541. Washington, D.C: U.S. Department of Agriculture, Forest Service; 1979. 375 p.*

Other hardwoods
- Black locust ..... *Robinia pseudoacacia*
- Honeylocust ..... *Gleditsia triacanthos*
- Kentucky coffeetree ..... *Gymnocladus dioicus*
- Northern catalpa ..... *Catalpa speciosa*
- Common persimmon ..... *Diospyros virginiana*
- Red mulberry ..... *Morus rubra*
- River birch ..... *Betula nigra*
- Sugarberry ..... *Celtis laevigata*
- Texas buckeye ..... *Aesculus glabra* var. *arguta*

Noncommercial species
- Ailanthus ..... *Ailanthus altissima*
- Eastern redbud ..... *Cercis canadensis*
- Hawthorn ..... *Crataegus* spp.
- Osage-orange ..... *Maclura pomifera*
- Eastern hophornbeam ..... *Ostrya virginiana*

DEFINITION OF TERMS

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Commercial forest land.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of annual growth under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.) Also see definition of pastured commercial forest land.

Commercial species.—Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam and hawthorn.)

Cull.—Portions of a tree that are unusable for industrial wood products, because of rot, form, or other defect.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards). The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet in width. Also see definitions of land area, commercial forest land, noncommercial forest land, productive-reserved forest land, stocking, unproductive forest land, nonforest land, and water.

Forest trees.—Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

Forest types.—A classification of forest land based upon the species forming a plurality of live tree stocking. Major forest types in Kansas are:

Eastern redcedar-hardwood.—Forests in which hardwoods comprise a plurality of the stocking but in which eastern redcedar comprises 25 percent or more of the stocking. Found on dry uplands, usually abandoned pastures or fields.

Oak-hickory.—Forests in which upland oaks (white, northern red, black) or hickory, singly or in combination, comprise a plurality of the stocking, except for stands classed as eastern redcedar-hardwood or as post-blackjack oak. Occurs on a variety of soils.

Post-blackjack oak.—Forests in which post oak or blackjack oak, singly or in combination, comprise a majority of the stocking. Occurs on dry uplands and ridges.

Upland plains hardwoods.—Forests in which black walnut, hackberry, and bur oak, singly or in combination, comprise a plurality of the stocking. Commonly found on slopes and uplands.

Elm-ash-cottonwood.—Lowland forest in which elm, ash, cottonwood, and willow, singly or in combination, comprise a plurality of the stocking, except for those in which cottonwood or willow comprise a majority of the stocking. Found on first or second bottoms of major streams.

Cottonwood.—Forests in which cottonwood comprises a majority of the stocking.

Willow.—Forests in which willow comprises a majority of the stocking.

Lowland plains hardwoods.—Forests in which black walnut, hackberry, bur oak, soft maple, and boxelder, singly or in combination, comprise a plurality of the stocking. Commonly found in coves and bottomlands.

Upland elm-ash-locust.—Upland forests in which elm, ash, and honeylocust, singly or in combination, comprise a plurality of the stocking. Includes shelterbelts and windbreaks on sites drier than those commonly associated with lowland species.

Growing-stock trees.—Live trees of commercial species qualifying as desirable and acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume in cubic feet of growing-stock trees 5 inches d.b.h. and over, from a 1-foot stump to a minimum 4 inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Cubic

feet can be converted to cords by multiplying by 79 cubic feet per solid wood cord.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous.

Land area.—A. *Bureau of the Census.*—The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs estuaries, and canals less than ⅛of a statute mile in width; and lakes, reservoirs, and ponds less than 40 acres in area.

B. *Forest Inventory and Analysis.*—The same as the Bureau of the Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.

Noncommercial forest land.—(a) Unproductive forest land and (b) productive-reserved forest land. See definitions of unproductive and productive-reserved forest land.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

Nonforest land.—Land that has never supported forests, and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and more than 1 acre in size, to qualify as nonforest land.)

A. *Nonforest land without trees.*—Nonforest land with no live trees present.

B. *Nonforest land with trees.*—Nonforest land with one or more trees at least 5 inches in d.b.h. per acre.

Nonstocked land.—Commercial forest land less than 16.7 percent stocked with growing-stock trees.

Other removals.—Growing-stock trees removed but not utilized for products, or trees left standing but "removed" from the commercial forest land classification by land use change. Examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Pastured commercial forest land.—Commercial forest land for which the primary use is wood production, but is presently used for grazing.

Poletimber trees.—Growing-stock trees of commercial species at least 5 inches in d.b.h., but smaller than sawtimber size.

Productive-reserved forest land.—Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administration regulation, designation, or exclusive use for Christmas-tree production, as indicated by annual shearing.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Roundwood products.—Logs, bolts, or other round sections (including chips from roundwood) cut from trees for industrial or consumer uses. (Note: Includes saw logs; veneer logs and bolts; cooperage logs and bolts; pulpwood; fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Saw log.—A log meeting minimum standards of diameter, length and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark (d.o.b.) for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting Regional specifications for freedom from defect. Softwoods must be at least 9 inches in d.b.h. Hardwoods must be at least 11 inches in d.b.h.

Sawtimber volume.—Net volume of the saw log portion of live sawtimber in board feet, International ¼-inch rule, from stump to a minimum 7 inches top d.o.b. for softwoods and a minimum 9 inches top d.o.b. for hardwoods.

Short-log (rough tree).—Live trees of commercial species that contain one merchantable 8- to 11-foot saw log but not a 12-foot saw log or two noncontiguous saw logs 8 feet or longer now or prospectively.

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-area class.—The extent of a continuous forested area of the same forest type, stand-size class, and stand-density class.

Stand-size class.—A classification of forest land based on the size class of growing-stock trees on the area; that is, sawtimber, poletimber or seedlings and saplings.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

Nonstocked stands.—Stands in which stocking of growing-stock trees is less than 16.7 percent.

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest productsannually (including roundwood products and logging residues) and for other removals.

Unproductive forest land.—Forest land incapable of producing 20 cubic feet per acre of annual growth or of yielding crops of industrial wood under natural conditions because of adverse site conditions. (Note: Adverse conditions include shallow soils, dry climate, poor drainage, high elevation, steepness, and rockiness.)

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.

Table 3.--Timber removals from growing stock and sawtimber on commercial forest land by species group, Kansas, 1964 and 1980, and projected annual harvest, 1982-1991

Species group	Growing stock			Sawtimber		
	1964[1]	1980	Projected annual harvest 1982-1991	1964[1]	1980	Projected annual harvest 1982-1991
	- - -Thousand cubic feet- - -			- - Thousand board feet[2]- -		
Softwoods						
Eastern redcedar	21	89	42	--	324	120
Total	21	89	42	--	324	120
Hardwoods						
White oak	1,368	2,483	5,566	4,599	7,482	22,206
Red oak	648	1,898	2,434	1,624	5,728	10,621
Hickory	611	359	1,112	1,717	1,178	3,506
Hard maple	12	15	222	4	41	322
Soft maple	667	500	1,298	2,732	2,126	4,910
Ash	607	1,629	2,983	1,550	5,484	9,706
Cottonwood	1,120	1,935	12,685	4,183	9,154	43,797
Basswood	19	17	230	11	66	774
Elm	848	685	2,147	2,539	2,538	3,975
Black walnut	1,180	1,307	1,614	7,240	8,281	5,461
Hackberry	626	1,220	4,923	2,351	4,890	16,558
Sycamore	259	320	1,508	903	1,611	5,090
Other hardwoods[3]	314	1,526	3,676	547	4,350	6,161
Total	8,279	13,894	40,398	30,000	52,929	133,087
All species	8,300	13,983	40,440	30,000	53,253	133,207

[1] Figures have been adjusted from those published after the 1966 survey to conform to 1980 volumes because of changes in survey definitions and procedures.

[2] International 1/4-inch rule.

[3] Includes willow and boxelder species groups.

Table 4.--Timber removals from growing stock and sawtimber on commercial forest land by item and species category, Kansas, 1980

Item	All species	Species category: Softwoods	Oak	Elm-hackberry	Ash	Cottonwood	Walnut	Other hardwoods
GROWING STOCK								
				-Thousand cubic feet-				
ROUNDWOOD PRODUCTS								
Saw logs	4,340	66	730	638	336	940	1,138	492
Veneer logs	72	--	12	--	--	--	60	--
Cooperage logs	40	--	40	--	--	--	--	--
Fuelwood	7,577	--	3,184	1,033	1,034	398	--	1,928
Posts	52	18	19	--	--	--	--	15
Total	12,081	84	3,985	1,671	1,370	1,338	1,198	2,435
LOGGING RESIDUE	755	--	231	69	137	140	109	69
OTHER REMOVALS	1,147	5	165	165	122	457	--	233
ALL TIMBER REMOVALS	13,983	89	4,381	1,905	1,629	1,935	1,307	2,737
SAWTIMBER								
				-Thousand board feet[1/]-				
ROUNDWOOD PRODUCTS								
Saw logs	26,269	312	3,358	4,017	1,991	6,107	7,431	3,053
Veneer logs	475	--	59	--	--	--	416	--
Cooperage logs	237	--	237	--	--	--	--	--
Fuelwood	20,895	--	8,773	2,850	2,851	1,097	--	5,324
Posts	114	11	62	--	--	--	--	41
Total	47,990	323	12,489	6,867	4,842	7,204	7,847	8,418
LOGGING RESIDUE	1,637	--	327	125	315	293	434	143
OTHER REMOVALS	3,626	1	394	436	327	1,657	--	811
ALL TIMBER REMOVALS	53,253	324	13,210	7,428	5,484	9,154	8,281	9,372

[1/] International 1/4-inch rule.

Table 5.--Area of commercial forest land qualifying for treatment by forest type and treatment class, Kansas, 1982-1991

(In thousand acres)

Forest type	All classes	Treatment class: Harvest	Thinning	Stand conversion or restocking	No treatment
Eastern redcedar-hardwood	27.5	1.4	--	4.6	21.5
Post-blackjack oak	30.9	1.2	5.7	1.2	22.8
Oak-hickory	316.6	69.6	15.8	24.1	207.1
Upland elm-ash-locust	110.3	6.4	7.4	24.0	72.5
Upland plains hardwoods	49.4	4.8	4.9	1.1	38.6
Cottonwood	68.1	53.1	--	6.5	8.5
Willow	4.2	1.0	--	2.0	1.2
Lowland plains hardwoods	265.9	82.4	33.9	19.2	130.4
Elm-ash-cottonwood	289.6	73.3	38.2	19.8	158.3
Nonstocked	45.4	--	--	45.4	--
All types	1,207.9	293.2	105.9	147.9	660.9

Table 6.--Average annual area of commercial forest land qualifying for treatment by forest type, site-index class and treatment class, Kansas, 1982-1991

(In acres)

Forest type	All classes	Site-index class (feet)							
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
HARVEST									
Eastern redcedar-hardwood	138	--	138	--	--	--	--	--	--
Post-blackjack oak	122	--	--	--	122	--	--	--	--
Oak-hickory	6,964	--	125	1,247	2,518	1,561	1,178	335	--
Upland elm-ash-locust	639	--	--	96	203	247	93	--	--
Upland plains hardwoods	481	--	--	--	234	247	--	--	--
Cottonwood	5,309	--	--	175	1,274	1,867	1,509	365	119
Willow	97	--	--	--	--	97	--	--	--
Lowland plains hardwoods	8,244	--	138	211	1,758	3,286	2,303	548	--
Elm-ash-cottonwood	7,330	--	--	297	2,003	2,569	1,939	421	101
Nonstocked	--	--	--	--	--	--	--	--	--
All types	29,324	--	401	2,026	8,112	9,874	7,022	1,669	220
THINNING									
Eastern redcedar-hardwood	--	--	--	--	--	--	--	--	--
Post-blackjack oak	571	--	223	--	232	116	--	--	--
Oak-hickory	1,583	--	157	--	382	446	331	146	121
Upland elm-ash-locust	744	--	--	121	296	115	--	212	--
Upland plains hardwoods	488	--	--	--	115	101	115	157	--
Cottonwood	--	--	--	--	--	--	--	--	--
Willow	--	--	--	--	--	--	--	--	--
Lowland plains hardwoods	3,391	--	--	380	466	892	742	818	93
Elm-ash-cottonwood	3,816	--	--	--	248	1,167	1,013	746	642
Nonstocked	--	--	--	--	--	--	--	--	--
All types	10,593	--	380	501	1,739	2,837	2,201	2,079	856
STAND CONVERSION OR RESTOCKING									
Eastern redcedar-hardwood	463	186	120	--	157	--	--	--	--
Post-blackjack oak	123	--	--	--	--	--	123	--	--
Oak-hickory	2,401	--	225	366	963	375	344	128	--
Upland elm-ash-locust	2,399	--	560	712	599	132	396	--	--
Upland plains hardwoods	110	--	--	--	110	--	--	--	--
Cottonwood	653	--	--	254	--	399	--	--	--
Willow	204	--	--	121	--	--	83	--	--
Lowland plains hardwoods	1,914	--	--	157	144	1,137	319	157	--
Elm-ash-cottonwood	1,980	--	--	271	638	574	497	--	--
Nonstocked	4,540	--	390	1,130	980	1,430	360	250	--
All types	14,787	186	1,295	3,011	3,591	4,047	2,122	535	--

Table 7.--Average annual area of commercial forest land qualifying for treatment by forest type, stand-age class and treatment class, Kansas, 1982-1991

(In acres)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
HARVEST														
Eastern redcedar-hardwood	138	--	--	--	--	--	--	--	--	--	--	--	138	--
Post-blackjack oak	122	--	--	--	--	--	--	--	--	--	--	122	--	--
Oak-hickory	6,964	--	--	--	--	--	--	--	--	1,513	1,495	2,555	1,171	230
Upland elm-ash-locust	639	--	--	--	--	--	--	--	--	220	202	96	121	--
Upland plains hardwoods	481	--	--	--	--	--	--	--	--	115	--	119	247	--
Cottonwood	5,309	--	--	--	--	727	661	1,575	810	229	673	634	--	--
Willow	97	--	--	--	--	--	97	--	--	--	--	--	--	--
Lowland plains hardwoods	8,244	--	--	--	--	--	--	--	3,747	1,420	1,987	869	119	102
Elm-ash-cottonwood	7,330	--	--	--	--	--	--	--	2,697	2,689	1,338	606	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	29,324	--	--	--	--	727	758	1,575	7,254	6,186	5,695	5,001	1,796	332
THINNING														
Eastern redcedar-hardwood	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Post-blackjack oak	571	--	--	--	339	232	--	--	--	--	--	--	--	--
Oak-hickory	1,583	--	--	--	614	969	--	--	--	--	--	--	--	--
Upland elm-ash-locust	744	--	--	--	532	--	115	97	--	--	--	--	--	--
Upland plains hardwoods	488	--	--	--	488	--	--	--	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Willow	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lowland plains hardwoods	3,391	--	--	--	1,443	331	1,617	--	--	--	--	--	--	--
Elm-ash-cottonwood	3,816	--	--	--	1,618	367	1,831	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	10,593	--	--	--	5,034	1,899	3,563	97	--	--	--	--	--	--
STAND CONVERSION OR RESTOCKING														
Eastern redcedar-hardwood	463	278	185	--	--	--	--	--	--	--	--	--	--	--
Post-blackjack oak	123	--	--	--	--	--	--	--	123	--	--	--	--	--
Oak-hickory	2,401	447	1,017	246	122	115	128	101	225	--	--	--	--	--
Upland elm-ash-locust	2,399	1,777	138	132	--	--	97	140	115	--	--	--	--	--
Upland plains hardwoods	110	--	--	--	--	--	--	110	--	--	--	--	--	--
Cottonwood	653	--	--	--	53	214	--	132	254	--	--	--	--	--
Willow	204	121	--	83	--	--	--	--	--	--	--	--	--	--
Lowland plains hardwoods	1,914	95	210	--	--	214	--	771	624	--	--	--	--	--
Elm-ash-cottonwood	1,980	240	885	128	123	128	319	--	157	--	--	--	--	--
Nonstocked	4,540	1,310	750	720	380	--	699	210	381	90	--	--	--	--
All types	14,787	4,268	3,185	1,309	678	671	1,243	1,464	1,879	90	--	--	--	--

Table 8.--Average annual growing-stock removals on commercial forest land qualifying for treatment by forest type, site-index class and treatment class, Kansas, 1982-1991

(In thousand cubic feet)

Forest type	All classes	Site-index class (feet)							
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
HARVEST									
Eastern redcedar-hardwood	129.2	--	129.2	--	--	--	--	--	--
Post-blackjack oak	99.3	--	--	--	99.3	--	--	--	--
Oak-hickory	7,610.4	--	89.0	947.3	2,504.4	1,865.2	1,786.0	418.5	--
Upland elm-ash-locust	593.0	--	--	61.5	163.4	279.0	89.1	--	--
Upland plains hardwoods	485.9	--	--	--	168.6	317.3	--	--	--
Cottonwood	11,116.8	--	--	94.0	2,011.2	3,047.0	4,014.8	1,372.2	577.6
Willow	35.7	--	--	--	--	35.7	--	--	--
Lowland plains hardwoods	10,923.1	--	133.8	149.1	1,852.7	4,440.0	3,097.6	1,249.9	--
Elm-ash-cottonwood	9,446.4	--	--	119.3	1,634.6	3,104.9	3,482.1	649.3	456.2
Nonstocked	--	--	--	--	--	--	--	--	--
All types	40,439.8	--	352.0	1,371.2	8,434.2	13,089.1	12,469.6	3,689.9	1,033.8
THINNING									
Eastern redcedar-hardwood	--	--	--	--	--	--	--	--	--
Post-blackjack oak	272.6	--	88.7	--	129.8	54.1	--	--	--
Oak-hickory	1,241.4	--	35.3	--	346.6	210.9	406.7	108.4	133.5
Upland elm-ash-locust	277.6	--	--	59.4	52.3	56.6	--	109.3	--
Upland plains hardwoods	280.4	--	--	--	56.1	43.2	33.2	147.9	--
Cottonwood	--	--	--	--	--	--	--	--	--
Willow	--	--	--	--	--	--	--	--	--
Lowland plains hardwoods	1,412.5	--	--	121.0	143.3	374.6	267.1	409.8	96.7
Elm-ash-cottonwood	2,388.3	--	--	--	136.1	417.0	726.3	553.8	555.1
Nonstocked	--	--	--	--	--	--	--	--	--
All types	5,872.8	--	124.0	180.4	864.2	1,156.4	1,433.3	1,329.2	785.3
STAND CONVERSION OR RESTOCKING									
Eastern redcedar-hardwood	27.6	13.0	4.5	--	10.1	--	--	--	--
Post-blackjack oak	53.1	--	--	--	--	--	53.1	--	--
Oak-hickory	514.4	--	24.2	26.3	128.9	67.4	217.8	49.8	--
Upland elm-ash-locust	401.7	--	28.0	153.2	87.5	--	133.0	--	--
Upland plains hardwoods	63.0	--	--	--	63.0	--	--	--	--
Cottonwood	294.3	--	--	124.6	--	169.7	--	--	--
Willow	29.5	--	--	--	--	--	29.5	--	--
Lowland plains hardwoods	970.6	--	--	57.8	94.7	511.5	206.1	100.5	--
Elm-ash-cottonwood	721.2	--	--	20.1	149.2	147.8	404.1	--	--
Nonstocked	359.1	--	--	67.2	64.7	195.6	31.6	--	--
All types	3,434.5	13.0	56.7	449.2	598.1	1,092.0	1,075.2	150.3	--

Table 9.--Average annual growing-stock removals on commercial forest land qualifying for treatment by forest type, stand-age class, and treatment class, Kansas, 1982-1991

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
HARVEST														
Eastern redcedar-hardwood	129.2	--	--	--	--	--	--	--	--	--	--	--	129.2	--
Post-blackjack oak	99.3	--	--	--	--	--	--	--	--	--	--	99.3	--	--
Oak-hickory	7,610.4	--	--	--	--	--	--	--	--	1,611.1	2,148.7	2,622.8	1,065.2	162.6
Upland elm-ash-locust	593.0	--	--	--	--	--	--	--	--	247.1	163.4	61.5	121.0	--
Upland plains hardwoods	485.9	--	--	--	--	--	--	--	--	118.7	--	49.9	317.3	--
Cottonwood	11,116.8	--	--	--	--	1,297.2	963.6	3,358.7	1,261.2	601.7	2,178.5	1,455.9	--	--
Willow	35.7	--	--	--	--	--	35.7	--	--	--	--	--	--	--
Lowland plains hardwoods	10,923.1	--	--	--	--	--	--	--	5,037.1	2,029.5	2,188.4	1,318.7	117.1	232.3
Elm-ash-cottonwood	9,446.4	--	--	--	--	--	--	--	3,822.7	2,955.7	1,512.1	1,155.9	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	40,439.8	--	--	--	--	1,297.2	999.3	3,358.7	10,121.0	7,563.8	8,191.1	6,764.0	1,749.8	394.9
THINNING														
Eastern redcedar-hardwood	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Post-blackjack oak	272.6	--	--	--	135.5	137.1	--	--	--	--	--	--	--	--
Oak-hickory	1,241.4	--	--	--	626.1	615.3	--	--	--	--	--	--	--	--
Upland elm-ash-locust	277.6	--	--	--	168.2	--	32.0	77.4	--	--	--	--	--	--
Upland plains hardwoods	280.4	--	--	--	280.4	--	--	--	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Willow	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lowland plains hardwoods	1,412.5	--	--	--	512.6	99.2	800.7	--	--	--	--	--	--	--
Elm-ash-cottonwood	2,388.3	--	--	--	745.6	198.4	1,444.3	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	5,872.8	--	--	--	2,468.4	1,050.0	2,277.0	77.4	--	--	--	--	--	--
STAND CONVERSION OR RESTOCKING														
Eastern redcedar-hardwood	27.6	14.6	13.0	--	--	--	--	--	--	--	--	--	--	--
Post-blackjack oak	53.1	--	--	--	--	--	--	--	53.1	--	--	--	--	--
Oak-hickory	514.4	28.7	129.6	41.3	13.3	51.5	35.8	71.2	143.0	--	--	--	--	--
Upland elm-ash-locust	401.7	234.1	18.5	--	--	--	30.0	48.0	71.1	--	--	--	--	--
Upland plains hardwoods	63.0	--	--	--	--	--	--	63.0	--	--	--	--	--	--
Cottonwood	294.3	--	--	--	17.7	93.0	--	59.0	124.6	--	--	--	--	--
Willow	29.5	--	--	29.5	--	--	--	--	--	--	--	--	--	--
Lowland plains hardwoods	970.6	17.6	52.9	--	--	109.6	--	432.7	357.8	--	--	--	--	--
Elm-ash-cottonwood	721.2	26.0	183.9	39.6	17.9	56.0	257.1	--	140.7	--	--	--	--	--
Nonstocked	359.1	51.3	23.0	56.6	60.3	--	66.5	31.6	39.4	30.4	--	--	--	--
All types	3,434.5	372.3	420.9	167.0	109.2	310.1	389.4	705.5	929.7	30.4	--	--	--	--

Table 10.- Average annual growing-stock and sawtimber removals on commercial forest land qualifying for treatment by forest type and treatment class, Kansas, 1982-1991

Forest type	Growing stock			Sawtimber		
	Harvest	Thinning	Restocking	Harvest	Thinning	Restocking
	- - - - Thousand cubic feet- - - -			- - - - Thousand board feet - - - -		
Eastern redcedar-hardwood	129.2	--	27.6	308.8	--	--
Post-blackjack oak	99.3	272.6	53.1	348.1	--	253.1
Oak-hickory	7,610.4	1,241.4	514.4	26,485.7	393.7	1,258.3
Upland elm-ash-locust	593.0	277.6	401.7	1,325.2	243.9	773.0
Upland plains hardwoods	485.9	280.4	63.0	1,149.3	--	220.2
Cottonwood	11,116.8	--	294.3	37,545.8	--	1,061.9
Willow	35.7	--	29.5	84.7	--	34.8
Lowland plains hardwoods	10,923.1	1,412.5	970.6	37,213.4	1,121.7	3,032.1
Elm-ash-cottonwood	9,446.4	2,388.3	721.2	28,745.8	2,736.9	1,978.9
Nonstocked	--	--	359.1	--	--	736.9
All types	40,439.8	5,872.8	3,434.5	133,206.8	4,496.2	9,349.2

Table 11.--Average annual growing-stock and sawtimber removals on commercial forest land qualifying for treatment by species group, tree class, and treatment class, Kansas, 1982-1991

Species group	Total all live	Growing stock		Short-log	Rough and rotten cull	Sawtimber	Short-log
		Poletimber	Sawtimber				
	Thousand cubic feet					Thousand board feet[1/]	
HARVEST							
Eastern redcedar	41.9	20.4	21.5	--	--	120.8	--
White oak	6,313.9	616.5	4,949.2	337.3	410.9	22,206.2	716.8
Red oak	2,569.6	179.6	2,254.6	31.7	103.7	10,621.2	109.0
Hickory	1,188.8	327.9	784.4	37.0	39.5	3,506.4	143.6
Basswood	272.8	80.5	149.6	7.9	34.8	773.5	26.8
Hard maple	229.4	150.1	71.6	5.6	2.1	321.5	17.5
Soft maple	1,385.3	113.4	1,184.9	37.5	49.5	4,909.8	101.6
Elm	2,447.9	1,282.3	864.9	106.2	194.5	3,974.9	304.3
Ash	3,287.5	913.8	2,068.9	149.6	155.2	9,705.7	440.8
Sycamore	1,519.8	79.8	1,428.0	--	12.0	5,089.9	--
Cottonwood	13,005.9	725.6	11,959.1	212.1	109.1	43,796.6	582.8
Willow	509.0	127.1	314.7	18.9	48.3	1,353.8	55.9
Hackberry	5,320.0	1,234.8	3,687.8	231.9	165.5	16,557.6	710.1
Black cherry	26.4	7.8	17.0	--	1.6	85.6	--
Black walnut	1,698.2	502.0	1,111.7	46.7	37.8	5,460.5	145.0
Boxelder	736.1	419.9	150.0	15.5	150.7	661.0	48.3
Other hardwoods	2,983.5	1,598.4	895.7	134.5	354.9	4,061.8	413.8
Noncommercial	146.3	146.3	--	--	--	--	--
All species	43,682.3	8,526.2	31,913.6	1,372.4	1,870.1	133,206.8	3,816.3
THINNING							
Eastern redcedar	8.1	8.1	--	--	--	--	--
White oak	836.3	683.2	23.5	81.0	48.6	104.4	203.3
Red oak	422.9	280.5	34.2	91.0	17.2	128.0	309.4
Hickory	401.7	299.8	48.1	30.9	22.9	230.4	99.7
Basswood	42.4	7.2	21.5	13.7	--	107.7	50.6
Hard maple	43.3	33.3	10.0	--	--	47.5	--
Soft maple	132.7	39.0	57.4	31.5	4.8	289.4	89.5
Elm	764.9	588.2	83.2	37.9	55.6	377.0	119.2
Ash	889.7	568.9	210.6	58.9	51.3	1,038.4	186.3
Sycamore	178.5	--	177.6	--	0.9	677.8	--
Cottonwood	14.7	--	--	7.8	6.9	--	9.0
Willow	107.3	21.9	32.9	6.1	46.4	167.4	19.0
Hackberry	539.1	389.7	30.1	76.8	42.5	147.0	222.4
Black cherry	49.2	48.0	--	--	1.2	--	--
Black walnut	325.8	261.1	16.3	32.0	16.4	77.7	96.6
Boxelder	577.0	432.2	18.4	38.4	88.0	81.7	120.6
Other hardwoods	1,865.3	1,174.2	228.7	73.8	388.6	1,021.8	222.3
Noncommercial	46.4	45.0	--	--	1.4	--	--
All species	7,245.3	4,880.3	992.5	579.8	792.7	4,496.2	1,747.9
STAND CONVERSION OR RESTOCKING							
Eastern redcedar	74.9	38.4	33.4	3.1	--	185.5	56.7
White oak	319.0	54.3	252.5	7.9	4.3	1,164.8	12.8
Red oak	136.1	23.2	100.2	6.9	5.8	453.4	23.1
Hickory	246.7	109.3	109.8	--	27.6	478.8	--
Basswood	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	--	--
Soft maple	--	--	--	--	--	--	--
Elm	355.8	245.2	49.0	21.0	40.6	223.4	64.3
Ash	200.1	95.2	69.6	9.2	26.1	333.5	28.3
Sycamore	149.5	29.6	119.9	--	--	484.3	--
Cottonwood	568.9	50.9	506.6	10.8	0.6	2,103.9	24.2
Willow	156.9	38.2	118.7	--	--	537.3	--
Hackberry	330.8	94.0	184.7	37.6	14.5	916.6	103.7
Black cherry	28.5	8.0	14.8	5.7	--	61.3	18.0
Black walnut	442.0	118.5	284.1	39.4	--	1,384.2	118.9
Boxelder	204.8	84.3	42.0	5.3	73.2	172.4	16.9
Other hardwoods	749.8	351.6	187.4	15.7	195.1	849.8	48.8
Noncommercial	21.1	21.1	--	--	--	--	--
All species	3,984.9	1,361.8	2,072.7	162.6	387.8	9,349.2	515.7

[1/] International 1/4-inch rule.

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Reviews treatment opportunities for timber stands in Kansas from 1982 to 1991. Under the assumptions and management guides specified, 45 percent of Kansas' commercial forest land would benefit from timber harvest or some other form of treatment during the decade.

KEY WORDS: Forest management, timber harvest, growing-stock volume, board-foot volume, commercial forest.